AMERICAN TECHNOLOGIES NETWORK CORP.

THERMAL IMAGING

NIGHT VISION

DIGITAL NIGHT VISION

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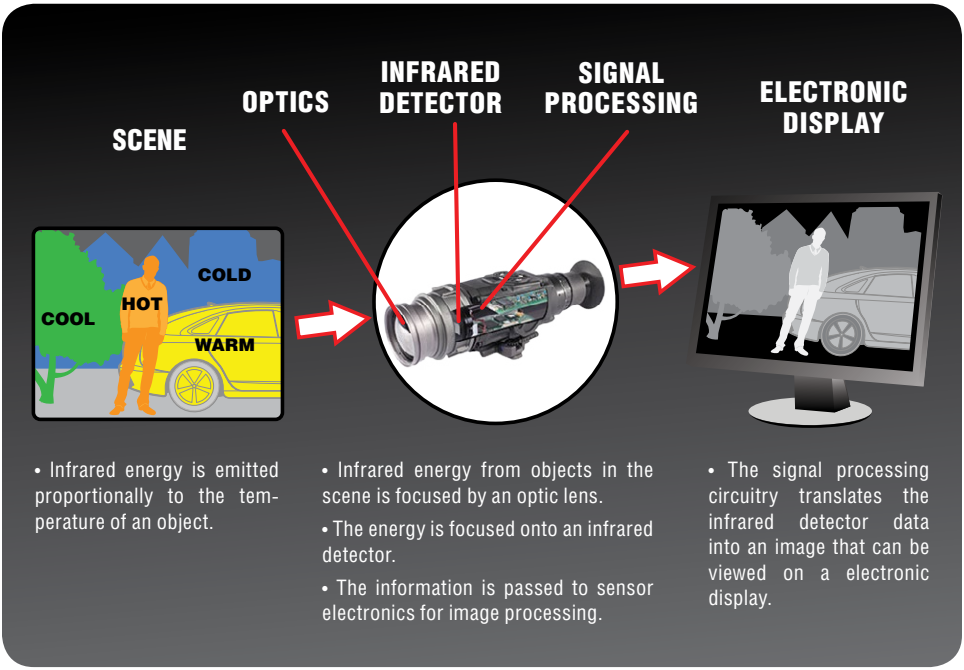
Version 1.1

HOW THERMAL IMAGING WORKS


SCENE
OPTICS
INFRARED DETECTOR
SIGNAL PROCESSING
ELECTRONIC DISPLAY
COLD
HOT
COOL
WARM
• Infrared energy is emitted proportionally to the temperature of an object.
• Infrared energy from objects in the scene is focused by an optic lens.
• The energy is focused onto an infrared detector.
• The information is passed to sensor electronics for image processing.
• The signal processing circuitry translates the infrared detector data into an image that can be viewed on a electronic display.

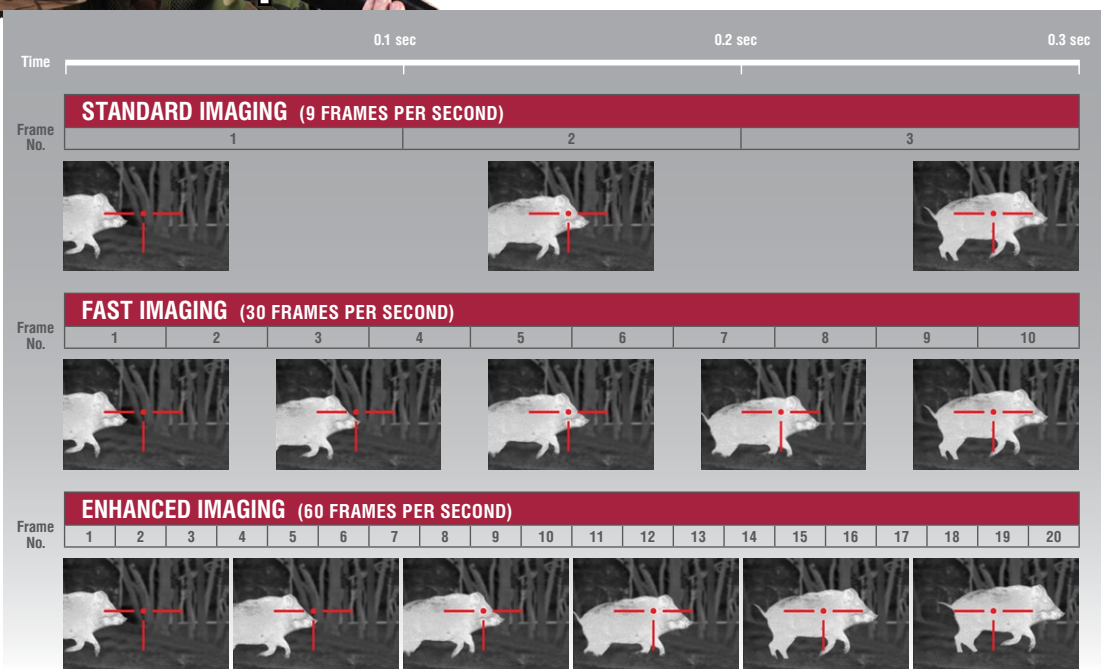
All objects, both natural and manmade, emit infrared energy as heat. By detecting very subtle temperature differences of everything in view, infrared (or thermal imaging) technology reveals what otherwise would be invisible to the naked eye. Even in complete darkness and challenging weather conditions, thermal imaging gives users the ability to see the unseen.

THERMAL GUIDE

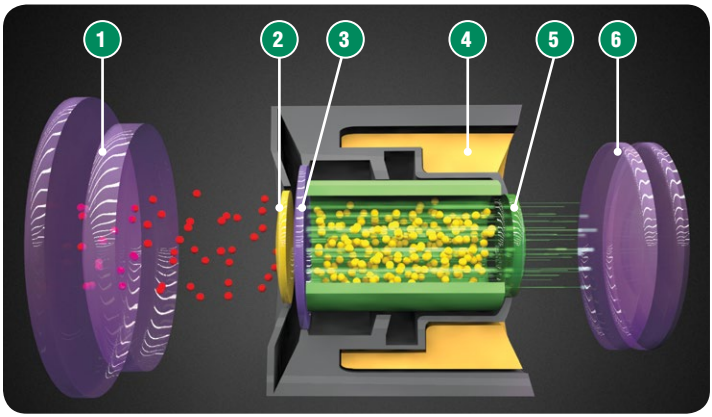
FLIR

VOx Sensor	Fast Imaging	Enhanced Imaging
320 x 240	30 Hz	60 Hz
640 x 480	30 Hz	Coming soon

Frames per Second



HOW NIGHT VISION WORKS



1 - FRONT LENS

2 - PHOTOCATHODE

3 - MICROCHANNEL PLATE

4 - HIGH VOLTAGE POWER SUPPLY

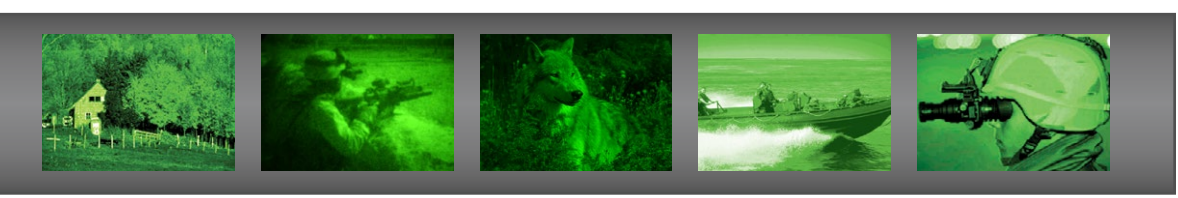
5 - PHOSPHORUS SCREEN

6 - EYEPIECE

All Starlight technology Night Vision Devices consist of several main parts: an objective lens, an eyepiece, a power supply and an image intensifier tube (Photocathode Tube).

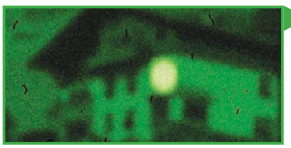
Night vision devices gather existing ambient light (starlight, moonlight or infra-red light) through the front lens. This light, which is made up of photons, goes into a photocathode tube that changes the photons to electrons.

The electrons are then amplified to a much greater number through an electrical and chemical process. The electrons are then hurled against a phosphorus screen that changes the amplified electrons back into visible light that you see through the eyepiece. The image will now be a clear green-hued amplified re-creation of the scene you were observing.



***** Do not remove lens covers while using in daylight! The covers usually have small pinholes to allow customers to test them in the store and sight-in riflescopes during the day.

NIGHT VISION GENERATIONS



Gen 1

1st generation units amplify the existing light several thousand times letting you clearly see in the dark. These units provide a bright visible image at a low cost.

- Photo cathode type: Single stage
- Resolution: 40 lp/mm

Gen 2 (2, CGT, HPT)

2nd generation units have a micro channel plate which amplifies the light many more times than gen 1 producing a brighter and sharper image.

- Photo Cathode type: Multi-Alkali
- Resolution from 40 (2) to 72 (HPT) lp/mm
- Signal-to-Noise Ratio from 16 to 22

Gen 3 (3, 3A, 3P)

3rd generation uses a Gallium Arsenide photo cathode which produces a higher light gain then gen 2. Generation 3 is the standard for the USA military.

- Photo Cathode type: Gallium Arsenide
- Resolution 64 – 73 lp/mm
- Signal-to-Noise Ratio 22 - 30

White Phosphor Technology™ (WPT™)

Studies show that nighttime scenes appear remarkably more natural in black and white versus the usual green. B&W provides clearer information about contrast, shapes and shadows. ATNs WPT™ units provide the user with this natural B&W night vision Image.

- Photo Cathode type: Multi-Alkali
- Resolution from 45 to 64 lp/mm
- Signal-to-Noise Ratio from 16 to 24

Gen 4 (Autogated/Filmless IIT)

G4 units are autogated which provide a high signal-to-noise ratio resulting in better image quality under low-light conditions. The filmless tube minimizes the “halo” effect often associated with light interference caused by street lights and other bright light sources.

- Photo Cathode type: Filmless GaAs
- Resolution from 64 to 72 lp/mm
- Signal-to-Noise Ratio from 25 to 30/Autogated power Supply

***** Do not remove lens covers while using in daylight! The covers usually have small pinholes to allow customers to test them in the store and sight-in riflescopes during the day.

NIGHT VISION GUIDE

Generation	Amplification Of Light	Tube Life	Range	Light Sensitivity
Gen 1	2000 times	2000 hours	75 - 100 yards	Full Moon or Active IR
Gen 2 (CGT, HPT)	20,000 times	5 - 10,000 hours	200 - 300 yards	1/4 to Half Moon
Gen WPT™	20 - 30,000 times	10,000 hours	Up to 250 yards	1/4 to Half Moon
Gen 3 (3A, 3P)	40 - 50,000 times	10,000 hours	300+ yards	Cloud Cover
Gen 4 (Autogated/Filmless)	40 - 50,000 times	10,000 hours	300+ yards	Cloud Cover

HUNTING & TACTICAL
NIGHT VISION GUIDE

RANGE YARDS 100 200 300

Weapon Sights	**MK350** **MK390** **MK410**	**ARES 4/6** (Gen. 2, CGT) **Night Arrow 2/4/6** (Gen. 2, CGT, WPT™)	**ARES 4/6** (HPT, WPT™) **Mars 4/6** (Gen. CGT, HPT)	**ARES 4/6** (Gen. 3, 3A, 3P, 4) **Mars 4/6** (Gen. 3, 3A, 3P, 4)
Goggles	**Viper X**	**NVG7** (Gen. 2, CGT) **PVS7** (Gen. 2, CGT)	**NVG7** (Gen. HPT, WPT™) **PVS7** (Gen. HPT, WPT™)	**NVG7** (Gen. 3, 3A, 3P) **PVS7** (Gen. 3, 3A, 3P)
Day/Night Systems	–	**PS22** (Gen. 2, CGT) **PS40** (Gen. 2, CGT)	**PS22** (Gen. HPT, WPT™) **PS40** (Gen. HPT, WPT™)	**PS22** (Gen. 3, 3A, 3P) **PS40** (Gen. 3, 3A, 3P,
Multi-Purpose Systems	–	**NVM14** (Gen. 2, CGT) **6015** (Gen. 2, CGT)	**PS22** (Gen. HPT, WPT™) **PS40** (Gen. HPT, WPT™)	**NVM14** (Gen. 3, 3A, 3P, 4) **6015** (Gen. 3, 3A, 3P, 4) **PVS14** (Gen. 3, 3A, 3P)

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$

Weapon Sights

Goggles

Day/Night Systems

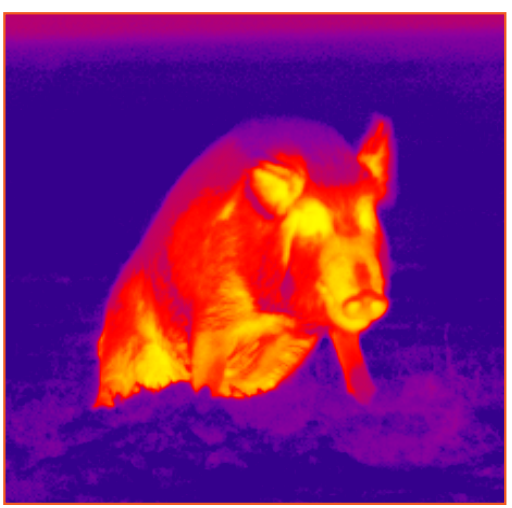
Multi-Purpose Systems

HUNTING & TACTICAL
THERMAL IMAGING GUIDE

RANGE YARDS 100 200 300

Thermal Imaging Weapon Sight	Thor 320 – 1X	Thor 320 – 2X	Thor 320 – 3X Thor 640 – 1.5X	Thor 320 – 4.5X Thor 640 – 2.5X	Thor 320 – 6X	Thor 320 – 9X	Thor 640 – 5X
Thermal Imaging Multi-Purpose Systems	Odin-31CW 1X Odin-31DW 1X	Odin-6WBW 0.5X	–	Odin-32CW 2X Odin-32DW 2X Odin-61BW 1X	–	–	–
Thermal Clip-on Sight	–	–	TICO-320 TICO-640	–	–	–	–

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$



Thermal Imaging Weapon Sight

Thermal Imaging Multi-Purpose Systems

CAMPING & BOATING
NIGHT VISION GUIDE

RANGE YARDS 100 200 300

Monocular	**Night Trek 3/5** **DNVM 2/4/6**	**Night Spirit XT** (Gen. 2, CGT)	**Night Spirit XT** (Gen. HPT, WPT™)	**Night Spirit XT** (Gen. 3, 3A, 3P)
Goggles	**Viper X** **Night Cougar LT**	**NVG7** (Gen. 2, CGT) **PVS7** (Gen. 2, CGT) **PS-15** (Gen. 2, CGT)	**NVG7** (Gen. HPT, WPT™) **PVS7** (Gen. HPT, WPT™) **PS-15** (Gen. HPT, WPT™)	**NVG7** (Gen. 3, 3A, 3P) **PVS7** (Gen. 3, 3A, 3P) **PS-15** (Gen. 3, 3A, 3P, 4)
Binoculars	**Night Scout** **Night Scout VX**	**Night Scout VX** (Gen. 2, CGT) **NVB3/5/8** (Gen. 2, CGT)	**Night Scout VX** (Gen. WPT™) **NVB 3/5/8** (Gen. HPT, WPT™)	**NVB 3/5/8** (Gen. 3, 3A, 3P)
Multi-Purpose Systems	–	**NVM14** (Gen. 2, CGT) **6015** (Gen. 2, CGT)	**NVM14** (Gen. HPT, WPT™) **6015** (Gen. HPT, WPT™)	**NVM14** (Gen. 3, 3A, 3P, 4) **6015** (Gen. 3, 3A, 3P, 4) **PVS14** (Gen. 3, 3A, 3P)

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$

Monocular

Binoculars

Goggles

Multi-Purpose Systems

CAMPING & BOATING
THERMAL IMAGING GUIDE

RANGE YARDS 500 750 1100 1500 2000

Thermal Imaging Viewers	OTS-X 1X (S/F/E-314) OTS-X 0.5X (S/F614)	–	OTS-X 2X (S/F/E-330) OTS-X 1X (S/F630)	OTS-X 4X (S/F/E-350) OTS-X 2X (S/F650)	OTS-X 6X (S/F/E-370) OTS-X 3X (S/F670)
Thermal Imaging Multi-Purpose Systems	Odin-31C/D 1X	Odin-6WB 0.5X	–	Odin-32C/D 2X Odin-61B 1X	–

LEAST EXPENSIVE — **MORE EXPENSIVE**

$ $$ $$$

Thermal Imaging Viewers

Thermal Imaging Multi-Purpose Systems

SECURITY
NIGHT VISION GUIDE

RANGE YARDS 100 200 300

Monocular	**MK350** **MK390** **MK410**	**ARES 4/6** (Gen. 2, CGT) **Night Arrow 2/4/6** (Gen. 2, CGT, WPT™)	**ARES 4/6** (Gen. HPT, WPT™) **Mars 4/6** (Gen. CGT, HPT)	**Mars 4/6** (Gen. 3, 3A, 3P, 4)
Goggles	**Viper X**	**NVG7** (Gen. 2, CGT) **PVS7** (Gen. 2, CGT)	**NVG7** (Gen. HPT, WPT™) **PVS7** (Gen. HPT, WPT™)	**NVG7** (Gen. 3, 3A, 3P) **PVS7** (Gen. 3, 3A, 3P)
Binoculars	**Night Scout** **Night Scout VX**	**Night Scout VX** (Gen. 2, CGT) **NVB3/5/8** (Gen. 2, CGT)	**Night Scout VX** (Gen. WPT™) **NVB 3/5/8** (Gen. HPT, WPT™)	**NVB 3/5/8** (Gen. 3, 3A, 3P)
Multi-Purpose Systems	–	**NVM14** (Gen. 2, CGT) **6015** (Gen. 2, CGT)	**NVM14** (Gen. HPT, WPT™) **6015** (Gen. HPT, WPT™)	**NVM14** (Gen. 3, 3A, 3P, 4) **6015** (Gen. 3, 3A, 3P, 4) **PVS14** (Gen. 3, 3A, 3P)

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$

Monocular

Binoculars

Goggles

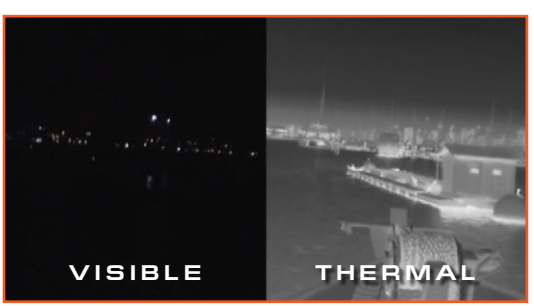
Multi-Purpose Systems

SECURITY
THERMAL IMAGING GUIDE

RANGE YARDS 500 750 1100 1500 2000

Thermal Imaging Weapon Sight	Thor 320 – 1X	Thor 320 – 2X	Thor 320 – 3X Thor 640 – 1.5X	Thor 320 – 4.5X Thor 640 – 2.5X	Thor 320 – 6X	Thor 320 – 9X	Thor 640 – 5X
Thermal Imaging Multi-Purpose Systems	Odin-31CW 1X Odin-31DW 1X	Odin-6WBW 0.5X	–	Odin-32CW 2X Odin-32DW 2X Odin-61BW 1X	–	–	–
Thermal Imaging Viewer	OTS-X 1X (S/F/E-314) OTS-X 0.5X (S/F614)	–	OTS-X 2X (S/F/E-330) OTS-X 1X (S/F630)	OTS-X 4X (S/F/E-350) OTS-X 2X (S/F650)	OTS-X 6X (S/F/E-370) OTS-X 3X (S/F670)	–	–

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$



Thermal Imaging Viewers

Thermal Imaging Weapon Sight

Thermal Imaging Multi-Purpose Systems

PUBLIC SAFETY
NIGHT VISION GUIDE

RANGE YARDS 100 200 300

Weapon Sights	**MK350** **MK390** **MK410**	**ARES 4/6** (Gen. 2, CGT) **Night Arrow 2/4/6** (Gen. 2, CGT, WPT™)	**ARES 4/6** (Gen. HPT, WPT™) **Mars 4/6** (Gen. CGT, HPT)	**Mars 4/6** (Gen. 3, 3A, 3P, WPT™ 4)
Goggles	**Viper X**	**NVG7** (Gen. 2, CGT) **PVS7** (Gen. 2, CGT)	**NVG7** (Gen. HPT, WPT™) **PVS7** (Gen. HPT, WPT™)	**NVG7** (Gen. 3, 3A, 3P) **PVS7** (Gen. 3, 3A, 3P)
Day/Night Systems	–	**PS22** (Gen. 2, CGT) **PS40** (Gen. 2, CGT)	**PS22** (Gen. HPT, WPT™) **PS40** (Gen. HPT, WPT™)	**PS22** (Gen. 3, 3A, 3P) **PS40** (Gen. 3, 3A, 3P, 4)
Multi-Purpose Systems	–	**NVM14** (Gen. 2, CGT) **6015** (Gen. 2, CGT)	**NVM14** (Gen. HPT, WPT™) **6015** (Gen. HPT, WPT™)	**NVM14** (Gen. 3, 3A, 3P, 4) **6015** (Gen. 3, 3A, 3P, 4) **PVS14** (Gen. 3, 3A, 3P)
Binoculars	**Night Scout** **Night Scout VX**	**Night Scout VX** (Gen. 2, CGT) **NVB3** (Gen. 2, CGT) **NVB5** (Gen. 2, CGT) **NVB8** (Gen. 2, CGT)	**Night Scout VX** (WPT™) **NVB3** (Gen. HPT, WPT™) **NVB5** (Gen. HPT, WPT™) **NVB8** (Gen. HPT, WPT™)	**NVB3** (Gen. 3, 3A, 3P) **NVB5** (Gen. 3, 3A, 3P) **NVB8** (Gen. 3, 3A, 3P)

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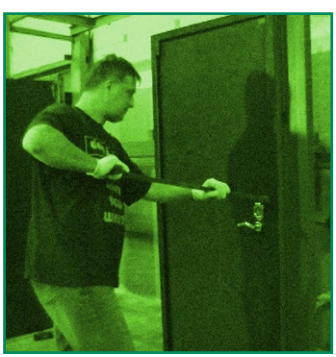

PUBLIC SAFETY
THERMAL IMAGING GUIDE

RANGE YARDS 500 750 1100 1500 2000

Thermal Imaging Weapon Sight	Thor 320 – 1X	Thor 320 – 2X	Thor 320 – 3X Thor 640 – 1.5X	Thor 320 – 4.5X Thor 640 – 2.5X	Thor 320 – 6X	Thor 320 - 9X	Thor 640 - 5X
Thermal Imaging Multi-Purpose Systems	Odin-31CW 1X Odin-31DW 1X	Odin-6WBW 0.5X	–	Odin-32CW 2X Odin-32DW 2X Odin-61BW 1X	–	–	–
Thermal Clip-on Sight	–	–	TICO-320 TICO-640	–	–	–	–
Thermal Imaging Viewer	OTS-X 1X (S/F/E-314) OTS-X 0.5X (S/F614)	–	OTS-X 2X (S/F/E-330) OTS-X 1X (S/F630)	OTS-X 4X (S/F/E-350) OTS-X 2X (S/F650)	OTS-X 6X (S/F/E-370) OTS-X 3X (S/F670)	–	–

LEAST EXPENSIVE $ $$ **MORE EXPENSIVE** $$$

Thermal Imaging Viewers

Thermal Imaging Weapon Sight

Thermal Imaging Multi-Purpose Systems

COMMON USED TERMINOLOGY

Automatic Brightness Control (ABC)

An electronic feature that automatically reduces voltages to the microchannel plate to keep the image intensifier's brightness within optimal limits and protect the tube. The effect of this can be seen when rapidly changing from low-light to high-light conditions; the image gets brighter and then, after a momentary delay, suddenly dims to a constant level.

Auto-Gated Power Supply

When the power supply is "auto-gated", it means the system is turning itself on and off at a very rapid rate. This, combined with a thin film attached to the microchannel plate (an ion barrier) reduces blooming. While "blooming" can be noticeably less on systems with a thin film layer, systems with thicker film layers can be perfectly acceptable depending on the end user's application. Deciding which night vision goggle is better should not be based solely on blooming.

Black Spots

These are common blemishes in the image intensifier of the NVD or can be dirt or debris between the lenses of the NVG. Black spots that are in the image intensifier do not affect the performance or reliability of a night vision device and are inherent in the manufacturing processes. Every night vision image intensifier tube is different.

lp/mm (Line Pairs per Millimeter)

Units used to measure image intensifier resolution. Usually determined from a 1951 U.S. Air Force Resolving Power Test Target. The target is a series of different-sized patterns composed of three horizontal and three vertical lines. A user must be able to distinguish all the horizontal and vertical lines and the spaces between them. Typically, the higher the line pair, the better the image resolution. Generation 3 tubes generally have a range of 64-72 lp/mm, although line pair measurement does not indicate the generation of the tube. SSome Gen 2 tubes measure 40-54 while gen 2 HPT tubes can be as high as 72lp/mm. Generation 1+ tubes have a 40lp/mm measurement at center image.

MCP (Microchannel Plate):

A metal-coated glass disk that multiplies the electrons produced by the photocathode. An MCP is found only in Gen 2 or Gen 3 systems. MCPs eliminate the distortion characteristic of Gen 0 and Gen 1 systems. The number of holes (channels) in an MCP is a major factor in determining resolution. ITT Industries' MCPs have 10.6 million holes or channels compared to the previous standard of 3.14 million.

Resolution

The ability of an image intensifier or night vision system to distinguish between objects close together. Image intensifier resolution is measured in line pairs per millimeter (lp/mm) while system resolution is measured in cycles per milliradian. For any particular night vision system, the image intensifier resolution will remain constant while the system resolution can be affected by altering the objective or eyepiece optics by adding magnification or relay lenses. Often the resolution in the same night vision device is very different when measured at the center of the image and at the periphery of the image. This is especially important for devices selected for photograph or video where the entire image resolution is important. Measured in line pairs per millimeter (lp/mm).

Signal-to-Noise Ratio (SNR)

A measure of the light signal reaching the eye divided by the perceived noise as seen by the eye. A tube's SNR determines the low-light-resolution of the image tube; therefore, the higher the SNR, the better the ability of the tube to resolve objects with good contrast under low-light conditions. Because SNR is directly related to the photocathode's sensitivity and also accounts for phosphor efficiency and MCP operating voltage, it is the best single indicator of an image intensifier's performance